

Appl. No: 09/380,447
Amendment Dated July 7, 2006
Reply to Office Action dated April 7, 2006

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

1. (Previously Presented) A fusion protein comprising a heterologous polypeptide fused to at least a portion of a variant of a wild type major coat protein of a virus selected from the group consisting of a filamentous phage, a lambda phage, a Baculovirus, a T4 phage and a T7 phage.

2. (Canceled)

3. (Currently Amended) The fusion protein of claim 1, wherein the virus phage is a filamentous phage, the wild type major coat protein is gpVIII and the heterologous polypeptide is fused to the N-terminus or the C-terminus thereof.

4. (Currently Amended) The fusion protein of claim 1, wherein the variant of a wild type major coat protein is a filamentous phage coat protein variant which contains at least one amino acid residue selected from the list below in the position indicated:

<u>Residue Number</u>	<u>Amino Acid Residue</u>
1	E, L, V, Q, D, I, N
2	R, H, F, W, E, K, Y, D
3	T, E, L, S, D, I, V, A
4	D, R, H, E, K
5	R, H, N, D, K, Q, E
6	Y, W, S, I, L, F, T, V
7	T, N, S
8	D, H, R, E, K
9	E, Q, T, D, N, S
11	W, I, V, Y, L, F
12	R, H, N, E, D, K, Q

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13	I, L, E, Q, A, V, D, T, N, S
14	L, I, V
15	D, R, N, E, K, H, Q
16	E, V, L, F, D, I, A, S, G
17	E, V, L, I, A, T, D
18	L, V, I
19	L, T, Q, E, I, V, S, A, N, D
20	R, D, H, N, Q, K, E
21	W, Y, I, L, F, V
22	W, F, Y
23	W, Y, I, V, H, K, F, L, R
24	I, Q, L, N, V
25	S, L, I, T, V
26	A, I, V, G, L, M
27	N, T, S
28	I, L, V
29	K, R, F, W, H, Y
30	I, V, L

5-6. (Canceled)

7. (Original) The fusion protein of claim 1, wherein the variant has 2 - 50 altered residues relative to the wild type coat protein sequence.

8. (Original) The fusion protein of claim 1, wherein the heterologous polypeptide is an antibody or a fragment thereof or a cytokine or a cytokine receptor.

9. (Original) A replicable expression vector comprising a gene fusion, wherein the gene fusion encodes the fusion protein of claim 1.

10. (Canceled)

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11. (Previously Presented) Host cells comprising the vector of claim 9.

12. (Previously Presented) A virus particle displaying the fusion protein of claim 1 on the surface thereof.

13-28. (Canceled)

29. (Withdrawn) The fusion protein of claim 1, wherein heterologous protein comprises at least one amino acid substitution in one or more regions of the molecule.

30. (Previously Presented) The fusion protein of claim 1 wherein the filamentous phage is selected from the group consisting of Ff, I_{ke}, I_{f1}, P_{f1}, P_{f3}, X_f, fd, f₁ and M13.

31. (Previously Presented) The fusion protein of claim 1, wherein the filamentous phage wild type coat protein is selected from the group consisting of SEQ ID NOS. 2, 3, 4, 5, 6, 7 and 8.

32. (Previously Presented) The fusion protein of claim 1, wherein the filamentous phage coat protein is a hyper-functional variant of the major coat protein that increases the number of fusion proteins incorporated into a virus particle.

33. (Previously Presented) The fusion protein of claim 1, wherein the filamentous phage coat protein variant is a hypo-functional variant of the major coat protein that decreases the number of fusion proteins incorporated into a virus particle.

34-43. (Canceled)

44. (Currently Amended) The fusion protein of claim 1, wherein the heterologous polypeptide is separated from the wild type major coat protein by a linking peptide.

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45. (Previously Presented) The fusion protein of claim 44, wherein the linking peptide is selected from the group consisting of SEQ ID NO:110, SEQ ID NO:112, SEQ ID NO:114, SEQ ID NO:116, SEQ ID NO:118, SEQ ID NO:134, SEQ ID NO:136, SEQ ID NO:138, SEQ ID NO:193, SEQ ID NO:195, SEQ ID NO:197, SEQ ID NO:199, SEQ ID NO:201, SEQ ID NO:203, SEQ ID NO:205, SEQ ID NO:207, SEQ ID NO:209, SEQ ID NO:211, SEQ ID NO:213, SEQ ID NO:215, SEQ ID NO:217, SEQ ID NO:219, SEQ ID NO:221, SEQ ID NO:223, SEQ ID NO:225, SEQ ID NO:227, SEQ ID NO:229, SEQ ID NO:231, SEQ ID NO:233, SEQ ID NO:235, SEQ ID NO:237, SEQ ID NO:239, SEQ ID NO:241, SEQ ID NO:243, SEQ ID NO:245, SEQ ID NO:247, SEQ ID NO:249, SEQ ID NO:251, SEQ ID NO:253, SEQ ID NO:255, SEQ ID NO:257, SEQ ID NO:259, SEQ ID NO:261, SEQ ID NO:263 and SEQ ID NO:265.

46. (Previously Presented) The fusion protein of claim 8, wherein the heterologous protein is an antibody or a fragment thereof.

47. (Previously Presented) The fusion protein of claim 46, wherein the antibody binds to a target selected from the group consisting of, cytokines, cytokine receptor superfamily receptors, hematopoietic growth factor superfamily receptors, human leukocyte surface markers, prolactin receptors, growth hormone receptors, ciliary neurotrophic factor receptors, C-Mpl receptors, erb2, erb3, erb4, IL-10, IL-12, IL-13 and IL-15.

48. (Withdrawn) The fusion protein of claim 47, wherein the human leukocyte surface marker is selected from the group consisting of CD1a-c, CD2, CD2R, CD3-CD10, CD11a-c, CDw12, CD13, CD14, CD15, CD15s, CD16, CD16b, CDw17, CD18-C41, CD42a-d, CD43, CD44, CD44R, CD45, CD45A, CD45B, CD45O, CD46-CD48, CD49a-f, CD50-CD51, CD52, CD53-CD59, CDw6O, CD61, CD62E, CD62L, CD62P, CD63, CD64, CDw65, CD66a-e, CD68-CD74, CDw75, CDw76, CD77, CDw78, CD79a-b, CD80-CD83, CDw84, CD85-CD89, CDw90, CD91, CDw92, CD93-CD98, CD99, CD99R, CD100, CDw101, CD102-CD106, CD107a-b, CDw108, CDw109, CD115, CDw116, CD117, CD119, CD120a-b, CD121a-b, CD122, CDw124, CD126-CD129, and CD130.

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49. (Withdrawn) The fusion protein of claim 47, wherein the cytokine receptor superfamily receptor is selected from the group consisting of IL-2b, IL-2g, IL-3, IL-4, IL-5, IL-6, IL-7, IL-9, granulocyte-macrophage colony-stimulating factor, granulocyte colony-stimulating factor, erythropoietin, leukemia inhibitory factor, and oncostatin M.

50-51. (Canceled)

52. (Withdrawn) The fusion protein of claim 4, wherein the major coat protein variant contains at least one amino acid residue selected from the list below in the position indicated:

<u>Residue Number</u>	<u>Amino Acid Residue</u>
1	D, I
2	K, Y
3	S
4	E
5	K
6	F
7	A, S
8	R, K
9	D, A

53. (Withdrawn) The fusion protein of claim 4, wherein the major coat protein variant contains at least one amino acid residue selected from the list below in the position indicated:

<u>Residue Number</u>	<u>Amino Acid Residue</u>
11	Y
12	E
13	A
14	L
15	E
16	D

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17	I
18	I, A
19	T
20	N

54. (Withdrawn) The fusion protein of claim 4, wherein the major coat protein variant contains at least one amino acid residue selected from the list below in the position indicated:

<u>Residue Number</u>	<u>Amino Acid Residue</u>
21	Y, L
22	F, I
23	F, R
24	L
25	L
26	G
27	T
28	V, M
29	Y
30	V

55. (Previously Presented) The fusion protein of claim 1, wherein the variant of the wild type major coat protein has at least one amino acid substitution.

56. (Previously Presented) The fusion protein of claim 1, wherein the variant of the wild type major coat protein has at least 8 amino acids substitutions corresponding to amino acid positions 1, 2, 3, 4, 5, 6, 8, and 9 of protein VIII.

57. (Previously Presented) The fusion protein of claim 1, wherein the variant of the wild type major coat protein has at least 7 amino acids substitutions corresponding to amino acid positions 11, 12, 13, 15, 17, and 20 of protein VIII.

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58. (Previously Presented) The fusion protein of claim 1, wherein the variant of the wild type major coat protein has at least 10 amino acids substitutions corresponding to amino acid positions 21, 22, 23, 24, 25, 26, 27, 28, 29, and 30 of protein VIII.